a voluminous treatise. But such treatment of the subject has a very high educational value and a certain ethical importance.

Further, it may be noted that the author has necessarily a difficulty to contend with in the scope itself of his book. Embryology is not a natural nor a convenient division of biological science. The study of the organism in its complete form cannot be advantageously separated from the study of the coming about of that form, and indeed it is very difficult for a writer who proposes to himself to describe the developmental changes of organisms to draw the line consistently in the various cases which he describes, and to say that at such a point his business with the organism ceases and that of the "antipædologist" begins. It is because the knowledge of embryological facts is to so large an extent new, that separate treatises on embryology are necessary. It is as a supplement to treatises on the structure or anatomy of animals which do not sufficiently deal with embryology that such a distinct treatise is needful, and such need is merely the result of the late development of embryological research.

In the course of time we shall no doubt see a complete fusion of "embryology" and "antipædology"—the facts of structure to be observed in the youth and in the maturity of organisms being treated as a matter of course concurrently. Nothing could conduce more directly to this desirable state of things than the really remarkable and successful effort which Mr. Balfour has made to gather together and present in a compact and logical form the embryological results which have been and still are pouring forth from Russian, German, English, French, and American laboratories in an overwhelming stream, calculated to daunt by its velocity any but the most determined student. E. RAY LANKESTER

THE SIEVE-TUBES OF DICOTYLEDONOUS PLANTS

Beiträge zur Kenntniss des Siebröhrenapparates dicotyler Pflanzen. Von Dr. Karl Wilhelm. (Leipzig: W. Engelmann, 1880.)

IT is perhaps natural, owing to its peculiarities, and especially to the character of the cell walls, that the soft bast was comparatively lately investigated and described;[1] but it is surely a surprising fact that the ground should have been left open till the present year, for a thorough investigation of the development of those tissues which are characteristic of the phloem.

In the "Comparative Anatomy" of De Bary we find a full account of what was known in 1877 of the structure and development of the soft bast; at the same time the writer pointed out several questions concerning which further investigation was required. He drew especial attention to our want of knowledge of the relation of the cambiform cells[2] to the sieve-tubes, and of the development of the sieve plate, the callus mass, and the contents of the sieve-tube. It has been the object of Dr. Wilhelm's researches to supply information on these several points; while at the same time he affords us many other interesting details.

Owing to the wideness of the subject it was impossible for the author to extend his researches beyond a limited number of types. Those selected were *Vitis vinifera*, L., *Curcubita pepo*, L., and *Lagenaria vulgaris*, Ser. It will be seen that Dr. Wilhelm has selected plants having sieve-tubes of the two different types common among the Dicotyledons, viz., Cucurbita and Lagenaria where the structure is more simple, Vitis where it is complicated by the presence of several sieve-plates side by side on the same cell wall. In a note at the end of the paper the author specially asserts that his results only apply to the plants named; while further research must show whether the structure described is really typical.

The main results arrived at are as follows:—Those formative cells of the bast which are set apart for the development of a member of a sieve-tube, usually suffer a longitudinal division into two unequal cells: the larger forms one member of the sieve-tube; the other, which is smaller and shorter, develops into the companion-cell (*Geleitzelle*). The latter may, in Cucurbita and Lagenaria, again divide. The walls separating the companion-cells from the sieve-tube are fitted, and the cell contents richly protoplasmic. It will be seen that these cells, being sister cells of the members of the sieve-tubes, must be distinguished from the larger cells, which are usually termed "cambiform;" these latter being formed by division from formative cells of the bast, but not being in direct genetic connection with the cells, which develop into members of the sieve-tubes.

Dr. Wilhelm finds that the "callous" condition of the sieve-plate is not, as previously supposed, the result of a secondary change of the plate; on the contrary, the differentiation of the sieve-plate begins by the change of the cellulose to "callus" at a number of points. It is in the callus masses, formed at these points, that the pores of the sieve later appear. The callus may extend itself from these points so as to cover the whole face of the plate, and completely inclose the cellulose sieve. A callus-skeleton is thus formed which may be isolated.

The callus varies in volume, increasing with age, or on approach of the period of rest; in which case the pores may be completely stopped; or decreasing as the period of summer activity approaches, when the pores are again opened. This result may be obtained by artificial means. It is best seen in Vitis; it is probable that this variation of volume of the callus is by no means universal.

As regards the substance of the callus it will be seen from the following reactions that it cannot be identified with any of the substances previously described. With acids and alkalies it swells quickly; if the reagents be strong it is dissolved. Ammoniacal sub-oxide of copper attacks it only slightly, or not at all; by use of this reagent the callus-skeletons before mentioned may be obtained free. Solution of iodine in alcohol does not colour it; solution of iodine in potassium iodide colours it yellow to brownish yellow. This with Schultz's solution gives a deep red brown; when used alone the latter reagent gives no colour, but causes considerable swelling.

Thus far we have only discussed the cell walls. While the development of the sieve has been going on, but before the perforations are formed, a change appears in

[1] The sieve tubes were discovered by Hartig (1837). His observations were many years after verified by other observers, especially von Mohl, Nägeli, and Hanstein.
[2] De Bary, "Vergl. Anat.," p. 337.

the contents of the young sieve-tubes. Isolated drops or irregular masses appear in the layer of protoplasm lining the cell cavity before the disappearance of the nucleus. These consist of a slimy stuff (*Schleim*) apparently rich in nitrogen.[1] The separate masses later fuse together to form a band, which is usually much narrower than the girth of the cell. Between this and the wall of the sieve tube a protoplasmic envelope intervenes (*Hüllschlauch*). The central cavity within these is filled with "sieve-tube sap." For further details concerning the contents of the sieve-tubes the reader must be referred to the original work.

The author has not been able to observe directly the first appearance of connection through the pores of the sieve; but suggests that it is effected by the outgrowth of protuberances of the envelope (*Hüllschlauch*) from opposite sides of the sieve, which penetrate it and coalesce to form the connecting strings.

The presence of starch grains noticed by Briosi is confirmed by Wilhelm in Vitis. He finds them in members of sieve-tubes which are still closed. He opposes the idea that they pass through the sieve on ground of their size. In Cucurbita and Lagenaria they are absent. Besides the communication of sieve-tubes with one another laterally, so as to form a complete system, Dr. Wilhelm has observed in the case of Vitis a further connection, through the medullary rays, of tubes lying on opposite sides of the ray. This is effected by special sieve tubes, produced by transformation of cells of the medullary ray, so as to form a series of very short members; these correspond in development and structure with the ordinary sieve-tube. They traverse the medullary rays in an obliquely tangential direction. Such communications are not found in Cucurbita or Lagenaria.

The question of function has not been solved by these observations. Dr. Wilhelm still holds the view, propounded by Nägeli, that the function of the sieve-tube is the transference of indiffusible substances from place to place in the plant.

In conclusion it may be remarked that the paper is well written, but that it is of such a character as to be interesting only to the specialist. The plates, of which there are nine, are executed with great skill and exactitude.

F. ORPEN BOWER

[1] Cf. De Bary, "Vergl. Anat.," p. 185.

OUR BOOK SHELF

The Elementary Geometry of Conics. By C. Taylor, M.A. Third Edition. (Cambridge: Deighton, 1880.)

MR. TAYLOR has been before the public as a writer on geometrical conics since 1863, in which year he brought out his "Geometrical Conics"; in 1872 we have the first edition, and in 1873 the second edition of his "The Geometry of Conics," a smaller work than his first book (1863). Now we have a third edition with the above title. In May, 1875, Mr. Taylor, in a paper entitled "On the Method of Reversion applied to the Transformation of Angles" (read before the Mathematical Society, and subsequently printed in a more extended form in the *Quarterly Journal*, No. 53, 1875, with the title "The Homographic Transformation of Angles"), called attention to a "neglected work on conics by G. Walker, F.R.S. (1794)": in this work we first meet with the properties of a circle, which Walker calls the *generating circle*, but which Mr. Taylor, in the work before us, styles the *eccentric circle*; in the free use of this circle consists the main feature in the alterations made in this new edition; further, though still keeping well in view the proving chord-properties independently of tangent-properties, there is a rearrangement of the text; so that the two properties are not treated of in distinct chapters. In other ways also we think this little work is improved, but we need say no more upon a third edition.

LETTERS TO THE EDITOR

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.*]

[*The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.*]

Ceraski's New Variable Star

UNLESS the principal fact mentioned below has already come to your notice, you may like to bring it before the astronomical public in the columns of NATURE.

The true period of the variable star recently discovered at Moscow (*Durchmusterung*, zone + 81°, No. 25) appears to be two days and a half, instead of five as given in NATURE, vol. xxii. p. 455. Minima were observed at the Harvard College Observatory on September 23 and 28. The changes of the star will accordingly be visible in England on October 13, 18, 23, 28, &c., during the three or four hours before or after midnight. The rapidity of the change is probably greater in the case of this star than in that of any other known variable, the variation exceeding a magnitude in the course of one hour. The total variation is more than two magnitudes. A star of about the eighth magnitude (No. 30 of the same zone) is within a few minutes of the variable, and may readily be compared with it. The phenomenon of the variation is consequently a striking one, even as seen in a small telescope. The approximate place of the variable for 1881 is in R.A. 0h. 51m. 48s., Decl. +81° 14'·1.

EDMUND C. PICKERING

Harvard College Observatory, Cambridge, U.S., October 2

LORD LINDSAY'S Dun Echt Circular, No. 10, which I received on Saturday morning, October 23, prepared me to watch for a probable minimum of M. Ceraski's remarkable variable star B.D. + 81° 25' on the same night. From my observations the minimum appears to have occurred at about 11h. 10m. G.M.T., the star then being of about 9·1 magnitude. At 9h. 5m. I noted it about equal to a neighbouring star, B.D. + 81° 30', which I gauged 8·1 mag., and at 13h. 50m. it had regained the same magnitude. When about minimum I thought the variable to be slightly ruddy, but as it brightened up again it lost this tint and appeared to be white, or bluish white, as when I first observed it. It has a small bluish 11½ mag. companion, the P. and D. of which I roughly estimated to be 60° and 10" respectively. The star was observed by Carrington in 1855, on December 19, 21, and 30, his estimated mags. being 8·0, 8·0, 9·0. Possibly the star may have been near minimum at his third epoch.

Knowles Lodge, Cuckfield, October 25 GEORGE KNOTT

"Solid Ice at High Temperatures"

THE interesting results announced by Prof. Thomas Carnelley, of Firth College, Sheffield, in relation to the physical conditions under which *ice* persistently maintains its *solid state* when exposed to the influence of heat (NATURE, vol. xxii. p. 435), deserves some notice. When he speaks of obtaining "solid ice at temperatures so high that it was impossible to touch it without *burning* one's self," it is evident that this *burning quality appertains to the hot vessel containing the ice, and not to the solid ice itself.* For it is obvious that under the given conditions *the temperature of the surface of the ice is kept at least as low as* 0° C. *by the rapid vaporisation of it while in a solid state.*

The phenomenon of a body remaining persistently at a low temperature when surrounded by a hot vessel—through the influence of the rapid change of state—is analogous to the well-known results of Boutigny and Faraday in relation to the freezing of water and mercury in a hot vessel by means of large